FROM SURVEY TO STRATEGY

Understanding Skills Trends in Advanced Manufacturing

March, 2024

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SUMMARY

This report examines the skills trends, qualifications demand, requisite professional profiles and the associated challenges in recruiting a skilled workforce within the advanced manufacturing sector. Based on data collected from CECIMO's survey in November 2023, encompassing responses from 44% large companies, 31% medium-sized enterprises, 16% small companies, and 9% micro-enterprises, the report aims to provide insights into the evolving landscape of skill demands and emerging professional profiles.

The objective of this report is to establish an updated skill database, serving as a valuable resource for industrial stakeholders, educational institutions, and policymakers. This database aims to monitor the dynamic nature of skill demands, address skill mismatches, facilitate the alignment of educational curricula with market needs, and attract a diverse workforce to the manufacturing sector, particularly the younger generation and women.

The report explores in-demand technical skills shortages sought-after professional profiles, emphasizing the labour and skills shortages, departments experiencing skills shortages, and recruitment challenges. Subsequently, the report examines anticipated digital-green skills and their corresponding professional profiles, highlighting how digitization and greenification are changing the emergence of new roles in contrast to existing ones. Finally, the report reflects on practices for talent acquisition and retention, upskilling and reskilling initiatives and concludes with policy recommendations.

1.INTRODUCTION

In the manufacturing sector, skills and talent gap together with retention and attraction of professionals are some of the most critical issues for companies. This challenge has been further intensified in the aftermath of the Covid-19 pandemic, despite the surge in European job vacancies reaching or surpassing the available workforce pool. Most businesses acknowledge that skills gaps hinder the transformation of their operations, yet the rapid evolution of industry demands outpaces the educational system. This increases the competition for new talent with the skills that are in demand.[1]

CECIMO's survey highlights that over half of industries recognise the significance of technical, digital, and green skills for current and future manufacturing activities, alongside the crucial role played by soft/transversal skills. The digital economy's explosive growth has heightened competition for Science, Technology, Engineering, Mathematics (STEM) graduates, where thegender imbalance is pronounced, with 2 in 3 STEM graduates being men. In addition, the manufacturing sector faces even greater challenges than other sectors (e.g. big tech) in attracting young STEM graduates, particularly women.

On the one hand, newer generations continue to perceive manufacturing jobs as dirty, hands-on work, often associated with minimal work-life balance in noisy factories. The reality of modern manufacturing is very different from this outdated image, however companies face challenges in revitalising the public perception of this dynamic industry.

On the other hand, technology remains a source of misunderstanding, especially among the older generation hesitant to join training sessions due to concerns over job automation and surveillance. It is imperative to emphasise that digital technologies complement human labour rather than replacing it. Proper training can reshape the perception of technology, enabling workers to collaborate effectively with technology instead by being replaced by it. For instance, integrating machine learning in white-collar jobs and robotics in blue-collar occupations, streamlines and automates manual tasks. While technology excels in executing manual work and processing vast datasets, it falls short in replacing humans in essential soft skills such as problem-solving, critical analysis, and assessing outputs.[2]

[1] World Economic Forum (2023) 'The Future of Jobs Report 2023,' available at: https://www.weforum.org/publications/the-future-of-jobs-report-2023/.
[2] World Economic Forum (2024) 'Putting Skills First: Opportunities for Building Efficient and Equitable Labour Markets,' available at: https://www.weforum.org/publications/putting-skills-first-opportunities-for-building-efficient-and-equitable-labour-markets/.

2. IN DEMAND: TECHNICAL SKILLS SHORTAGES AND THE ROLE OF PROFESSIONAL PROFILES

CECIMO's previous report on skills: "Transformation of Manufacturing: Embracing Digital and Green Skills" has highlighted the prevalent dual challenge faced by companies experience: labour shortages and skills deficiencies.. The scarcity of labour stems from the current difficulty in attracting a sufficient number of interested applicants, exacerbated by the perceived lack of attractiveness of the sector, particularly among younger generations. At the same time, the skills shortages are also a direct consequence of lack of qualifications possessed by the workforce to execute technical tasks.

2.1 LABOUR AND SKILLS SHORTAGES IN FOCUS

According to the survey results in Figure 1, 43.3% of industries acknowledge experiencing a significant shortage in their workforce, with a further 30% reporting a moderate shortage.

Workforce shortages are driven by the need to replace retiring workers who retire and the reluctance of young people to pursue careers in manufacturing as well as the evolving skills needs in the context of the twin transition. The European Commission's report (2023)[3] Employment and Social Developments in Europe (ESDE) underpins that labour shortages in STEM and ICT (Information and Communications Technology) are likely to escalate in light of the anticipated reduction in the working-age population.

Figure 1. Labor Shortages across production line
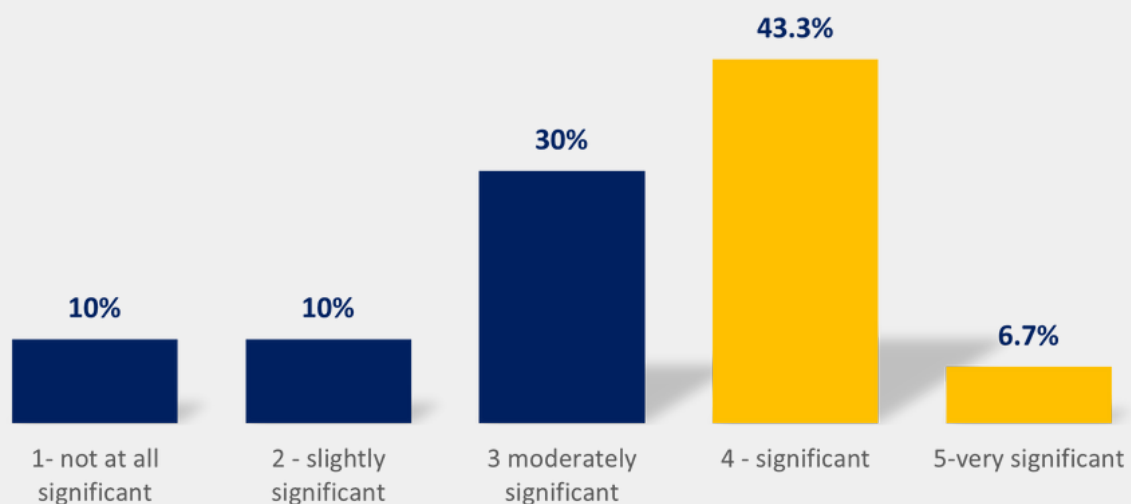
[3] European Commission (2023) 'Employment and Social Developments in Europe (ESDE),' available at: https://ec.europa.eu/commission/presscorner/detail/en/ip_23_3704.

Figure 2 reveals significant skills shortages, particularly in Electrical Engineering, Production, and Mechanical/Industrial Engineering, accounting for 59%, 54%, and 40%, respectively (considering both significant and very significant rates). Conversely, departments such as Finance and Administration Control, Logistics, Sales/Marketing do not experience significant skills shortages, with rates of 55%, 40%, and 38%, respectively. A compelling observation is made in the arise of Mechanical/Industrial Engineering, where the incidence of skills shortages varies across respondents. Approximately 20% of companies report experiencing either a slight shortage or no shortage at all.

Figure 2. Current Skills shortages
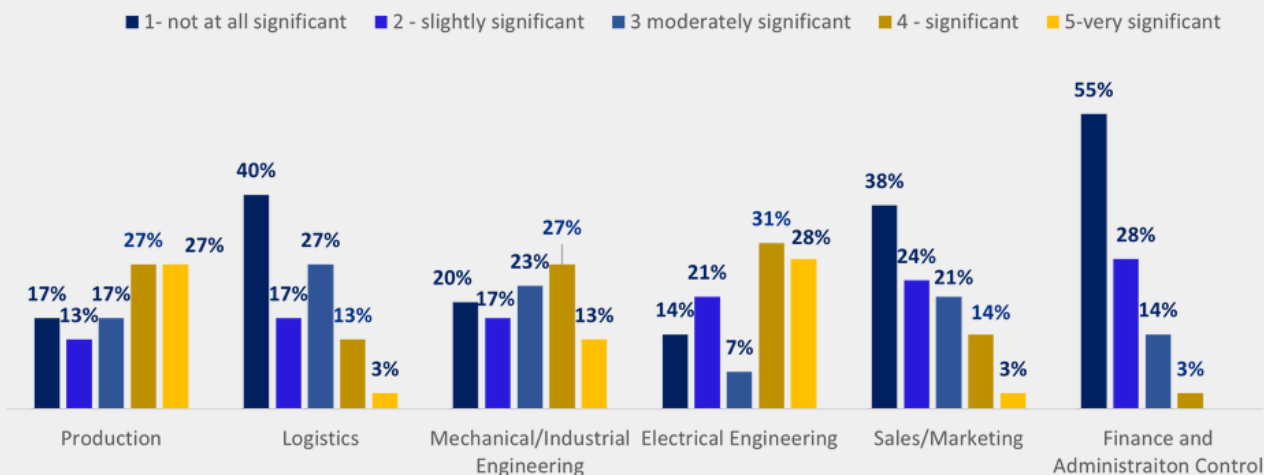
Figure 3 reinforces the prevailing challenges in addressing skills shortages and recruitment obstacles within advanced manufacturing. Approximately 57% of employers view deficiency in knowledge and skills related to technical fields and automated digital technologies as a central factor contributing to the skills gap. The expertise in machinery possessed by experienced staff, as seen in previous charts, further emphasises the difficulty in finding adequately qualified candidates in the labour market, worsening the skills shortage.

In addition to this, 40% of industries perceive training as a time-consuming endeavour. This perception is rooted in the understanding that workers need time to absorb the skills learned during training. At the same time, this places an additional workload on the team responsible for providing training, slowing down the production processes and the economic activity of the company. This impact is particularly pronounced within SMEs, where human resources are limited, and any time spent on training may result in a decrease in production efficiency. Additionally, the financial implications of training, acknowledged by nearly 17% of companies, introduce another layer of complexity, especially when training centres provide training away from the company premises.

Beyond the afore-mentioned challenges, 30% of companies face   the hesitancy of an ageing workforce toward adopting new technologies. This hesitancy can be attributed to various factors, including concerns over digital or technology-based training, adaptability to digital technologies and their operation, the adoption of new processes or work methodologies, and fear of job insecurity.

Additionally, 13% of industries report a limited availability of in-depth training courses, leaving individuals poorly prepared for the industry's demands. This scarcity or unavailability of tailored training programmes results in a lack of specialised knowledge required in departments such as production, electrical engineering, and mechanical/industrial engineering.

Figure 3. Factors Contributing to Current Skills Gaps
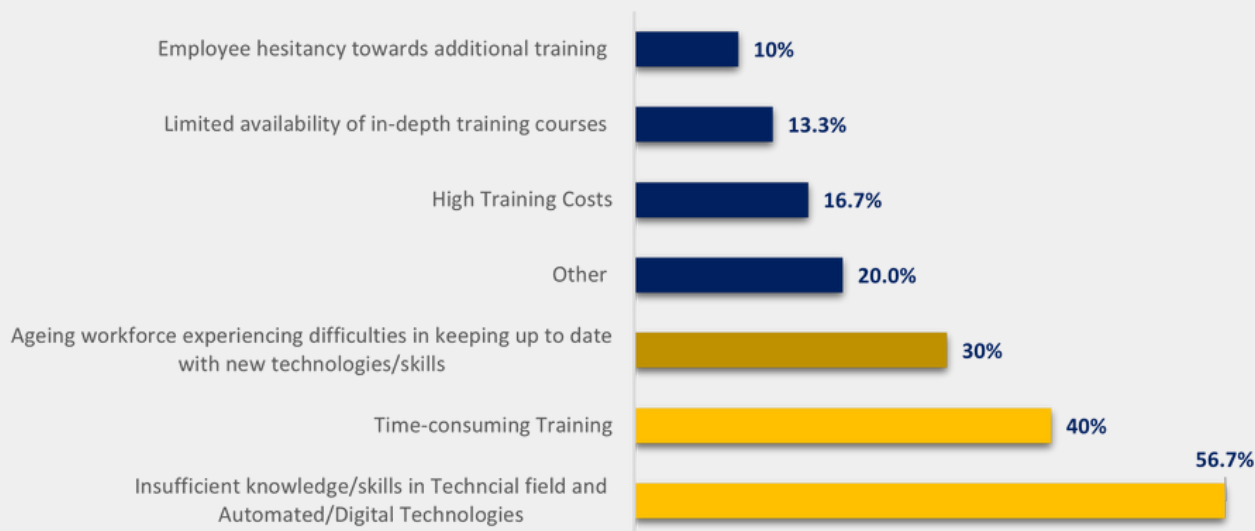
2.2 RECRUITMENT CHALLENGES

Figure 4 sheds light on the hiring challenges encountered by companies across various technical professional profiles in advanced manufacturing. Notably, a significant of 53.3% of companies are struggling to find talent for critical roles such as Software, Programmable Logic Controllers (PLC), Graphics Developers and Managers, alongside Electrical/Electronic Engineers, Electrotechnicians. Additionally, nearly 47% face difficulties in recruiting Service Engineers, Design Engineers and Technical Draftsmen, as well as Computer Numerical Control (CNC) Operators/Machinists and Mechanical Engineers, highlighting the widespread to attract talent for key technical and design roles.

Furthermore, the data reveals that around 43% of enterprises have difficulties in securing qualified professionals for Maintenance Technicians roles, while 40% face challenges in hiring for positions such as Machine Operators and Testers, Service Technicians, Relocators and Installers. Beyond this, the insights highlight nuanced hiring needs, with over 25% of industries experiencing obstacles in recruiting Mechanical Fitters, Assemblers, and Machine Fitters, and approximately 20% facing difficulties in acquiring talents for roles such as Metrology Workers and Assembly Operators 4.0. The findings emphasise the strategic need for additional recruitment efforts to address these challenges effectively.

Figure 4. Recruitment Challenges in Technical Professionals
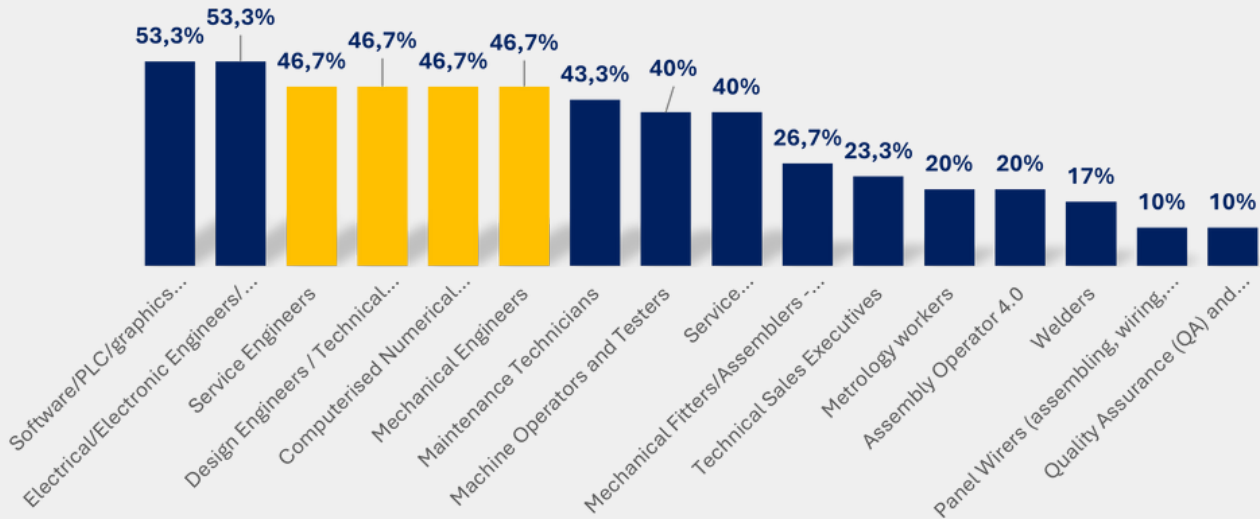
In Figure 5, analysis of the survey data shows the primary challenges encountered by respondents in the recruitment process. A substantial 70% of participants identify the lack of interested applicants in their recruitment processes. Additionally, nearly 57% of respondents acknowledge the significance of the lack of required qualifications as a contributing factor to this challenge, reaffirming the complexity of the dual shortage issue faced by companies.

Other specific factors contributing to recruitment difficulties pinpointed by 27% of enterprises are the absence of technical competencies, highlighting the demand for specialised skills in the candidate pool. Simultaneously, 20% of respondents recognise compensation and benefits packages in this sector as a notable barrier for potential applicants, emphasising the importance of a competitive remuneration structure in attracting top-tier talent. This is especially visible for smaller companies struggling with financial constraints. Only a small percentage of companies perceive geographical location as a potential negative factor affecting the inflow of interested candidates. Other factors flagged by companies include extensive travel requirements, such as for machine maintenance, which require employees to be away from home for long periods. This observation aligns with the industry trends, where skilled labour tends to be concentrated in central and high-demand locations.

Figure 5. Reasons for Recruitment Difficulty
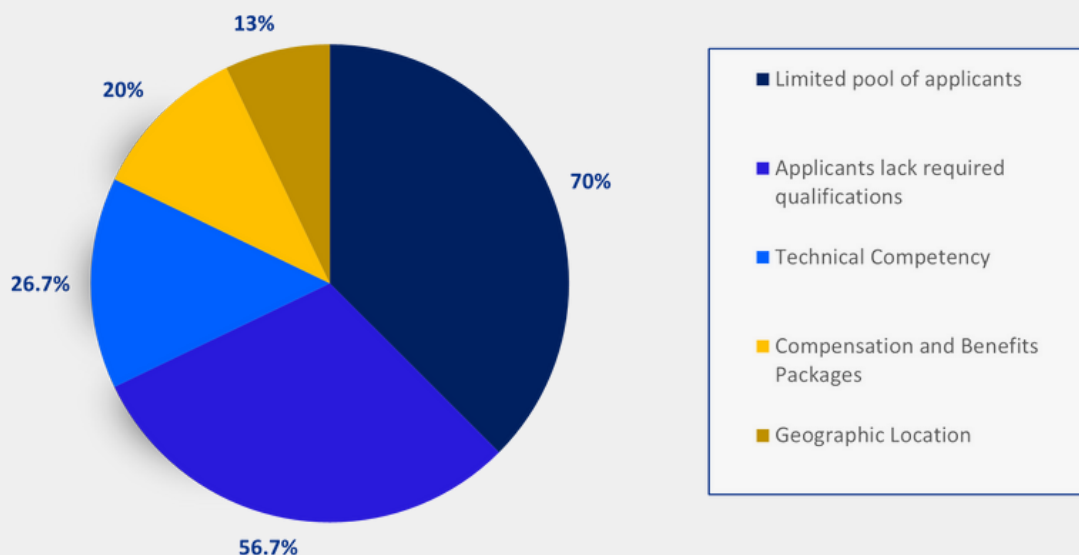
In Figure 6, which addresses the challenges enterprises face in retaining a qualified workforce, there is a variation in the perceived difficulty among advanced manufacturing companies. The majority, comprising 30% of companies, indicate a moderate level of difficulty in retaining a skilled workforce. This suggests a balanced landscape where challenges are not overwhelmingly severe but still present a concern, requiring strategic attention to employee retention initiatives.

On the one side, nearly 27% of industries say that they are finding it somewhat difficult to retain their workforce. This group may be experiencing relatively minor challenges in retaining skilled staff. Conversely, an equal percentage, also at 27% of companies, assert that it is difficult to retain their staff, possibly influenced by heightened competition for skilled workers, industry-specific challenges, or a need for enhanced retention initiatives.

Figure 6. Difficulty in Retaining Skilled Workers
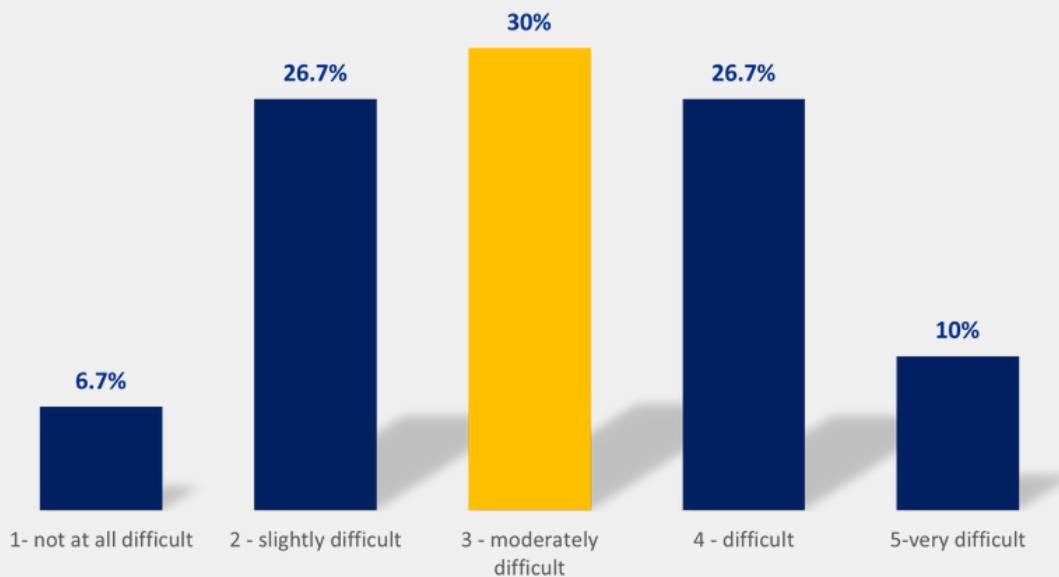
3. DIGITAL AND GREEN SKILLS ON THE HORIZON

Forecasting future skills demands involves navigating a complex landscape of evolving industry trends and technological advancements. Over the next 5 years, a significant transformation is anticipated in many core skills essential for the manufacturing sector. The increasing integration of automation, Artificial Intelligence (AI) and data-driven processes underscores the imperative for workforce proficiency in areas such as data analytics, robotics, cybersecurity, machine learning etc. Furthermore, expertise in sustainable practices, environmental resource optimisation, and the circular economy is expected to become increasingly vital for industries to involve professionals skilful in environmental impact analysis. Notably, transversal skills like communication, problem-solving, and flexibility/adaptability are expected to grow in importance, indicating a shift in the skill set required for success in the manufacturing industry.

Figure 7 presents the importance of skills in the manufacturing sector, revealing that 77% and 70% of industries (combining significant and very significant rates) regard Digital skills and Hard Technical skills as paramount for their operational success. The surge in technological transformation, marked by the adoption of digitalised technologies and automated manufacturing processes, reasonably explains the unsurprising prominence of digital and hard/technical skills.

Notably, Soft/Transversal skills, encompassing communication, analytical thinking, flexibility/adaptability, leadership, resilience etc., are emerging as significant contributors to industry success, acknowledged by 56% of enterprises. **Despite discussions about AI and automation potentially displacing jobs, the data highlights the enduring value placed on human skills, emphasising their irreplaceable role in the eyes of employers and their significant distance from being replaced by machines.**

Lastly, more than half of industries (53%) recognise the role of green skills, aligning with companies' endeavours toward sustainable practices. Green skills are swiftly becoming an indispensable component of corporate green transitions, positioning themselves as imperative in achieving the ambitious Green Deal goal by 2050. However, 27% of companies indicate only slight significance of green skills in their business activities, which shows the varied perspectives within industries.

Figure 7. Importance of Skills Categories in Advanced Manufacturing

Legend: Digital Skills · Green Skills · Hard skills · Soft/Transversal skills

Category	Digital Skills	Green Skills	Hard skills	Soft/Transversal skills
Slightly Significant	27%	10%	—	13%
Moderately Significant	20%	10%	20%	30%
Significant	37%	30%	33%	33%
Very Significant	40%	23%	37%	23%
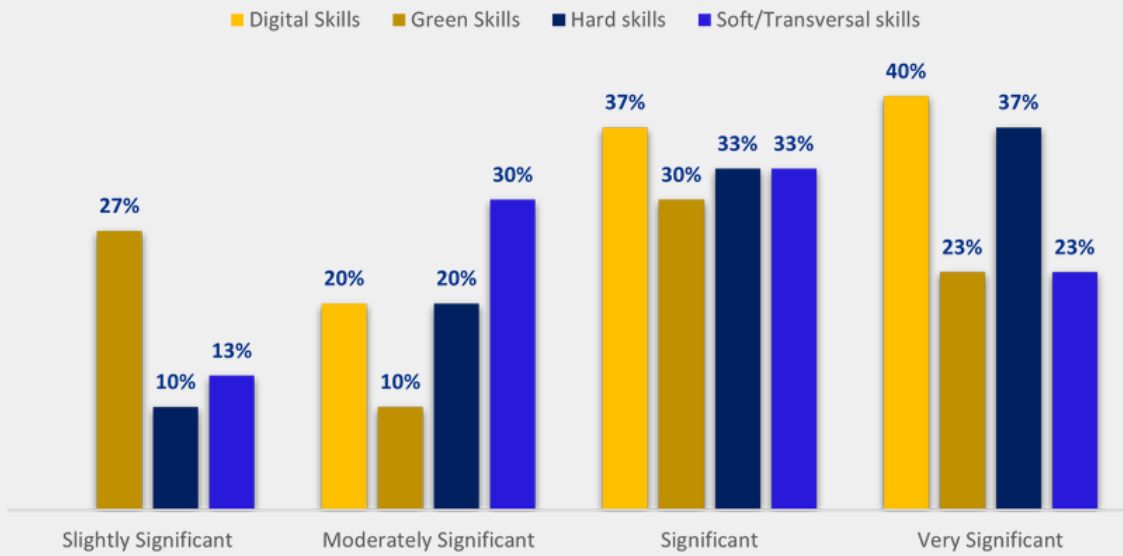
Traditional jobs are changing, creating new roles that require acquiring new skill sets. Figure 8 illustrates how companies perceive the impact of Digitisation and Greenification of manufacturing on skills landscape. A substantial majority, nearly 55% of industries, agree with the statement that existing roles will undergo significant changes, foreseeing potential benefits for their respective companies. Additionally, almost 39% anticipate the emergence of new roles, either as replacements or complements traditional positions, resulting in a positive impact. On the flip side, 16% of companies hold a pessimistic view, perceiving a negative impact on their organisations. Furthermore, approximately 19% believe that skills requirements for existing roles will evolve without major role changes, expecting a more gradual evolution and thus, their company may not be significantly impacted.

Figure 8. Impact of Digitisation and Greenification of Manufacturing on Skills Landscape

Statement	Percentage
Existing roles will undergo significant changes, potentially impacting my company positively.	54.8%
New roles will immerge, either replacing or complementing traditional roles, resulting in a positive impact on my company.	38.7%
Skills requirements for existing roles will evolve without major role changes and my company may not be significantly impacted.	19.4%
New roles will immerge, replacing and/or complementing traditional roles, resulting in a negative impact on my company.	16.1%
Existing roles will undergo significant changes, potentially impacting my company negatively	12.9%

3.1 DIGITAL SKILLS IN ADVANCED MANUFACTURING

Approximately 52% of enterprises partially agree that the shortage of skills hinders their adoption of digital technologies in manufacturing processes. On the contrary, around 32% partially disagree with this assertion. This perception may arise from the widespread adoption of digital technologies by most companies. Consequently, the deficiency in qualified personnel—those skilled in operating, programming, and maintaining these technologies—is closely tied to the manufacturing of relevant technologies and machine tools. To offer a broader perspective, it can be said that around 65% of companies (considering both somewhat agree and totally agree ratings) perceive skills shortages as an obstacle to the adoption of digital technology, while only 32.3% do not view it as a barrier.

Figure 9. Impact of Skills Shortages on Digitisation of Business Activities
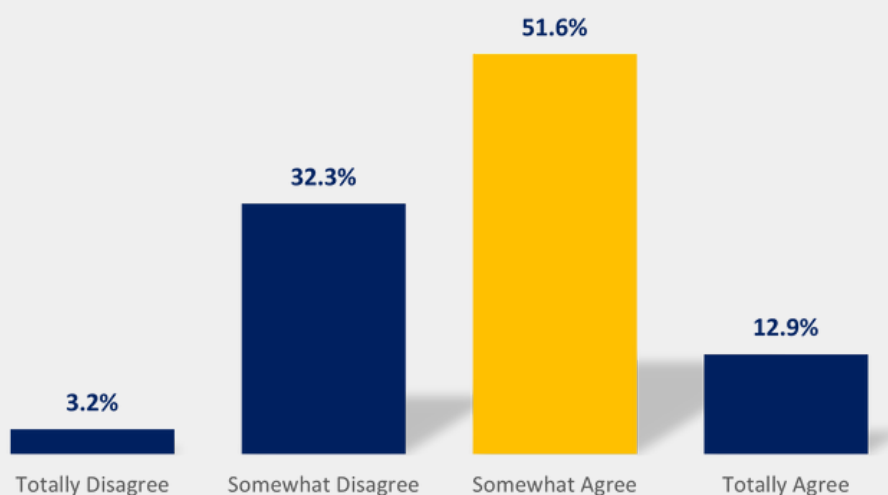
Figure 10 offers insight into the digital skills considered vital by companies in their current and future production landscapes. **The survey reveals that almost 55% of enterprises recognise the significance of Automation Control Systems in automating manufacturing processes, while approximately 48% affirm the importance of Data Analytics and Visualisation skills**. This highlights a growing awareness of the value of data-driven decision-making and the visualisation of complex datasets in optimising manufacturing processes. In addition, **45% of industries acknowledge the necessity of a diverse set of expertise, including Robotics Operations, Programming, Integration and Maintenance, Troubleshooting and Collaborative Robotics (Cobots), Machine Learning skills and AI management.**

Moving forward, roughly one-third (35.5%) of companies place significant importance on skills in Computer-Aided Design (CAD) and Computer-Aided Manufacturing (CAM) Software, which underscores the integral role of design and manufacturing software in shaping contemporary production processes.

Likewise, a notable 32% of businesses prioritise digital skills in Internet of Things (IoT) and sensor Integration, coupled with Cybersecurity awareness, reflecting the industry's proactive stance towards mitigating cyber threats. Concurrently, 29% of companies emphasise the importance of 3D Modelling and Simulation, along with Computer Numerical Control (CNC) Programming, signifying the increasing relevance of these skills in optimising manufacturing processes. Digital Twin Modelling skills are cited by almost 26% of companies, demonstrating a growing interest in leveraging digital representation for manufacturing enhancement. However, skills in Augmented Reality (AR) and Virtual Reality (VR) are not considered a significant priority for advanced manufacturing companies, suggesting that, at present, these technologies may not be perceived as essential components of the skill set required for digital transformation.

Figure 10. Digital Skills Necessary in Industry's Production Processes

Skill	Percentage
Automation Control Systems for automating…	54.8%
Data Analytics And Visualisation	48.4%
Robotics Operation/Programming/Integration/…	45.2%
Machine Learning skills and AI management	45.2%
Computer-Aided Design (CAD) and Computer-Aided…	35.5%
IoT and sensor integration	32.3%
Cybersecurity awareness: Incident Response and…	32.3%
3D Modelling and Simulation; Computer Numerical…	29%
Digital Twin Modelling	25.8%
Supervisory Control and Data Acquisition (SCADA)…	6.5%
Data Integration and Extract, Transform Load (ETL) skills	6.5%
AR/VR Integration	3.2%

3.2 DIGITAL PROFESSIONAL PROFILES

Figure 11 gives a glimpse into the anticipated Digital Professional Profiles that will be crucial in shaping the manufacturing landscape over the next 5-10 years. A substantial majority, 58% of industries, identifies Automation and Mechatronic Systems Technicians as fundamental for installing, maintaining, and repairing automated machinery and robotic systems, thereby minimising downtime in manufacturing. Additionally, around 48% of companies, emphasises the importance of Robotics Specialists/Human-Robot Interaction Operators, responsible programming, monitoring performance and operating robotic systems, along with security and Cybersecurity Specialists, IoT Specialists and Security Analysts, who are tasked to protect digital systems and manage security measures against cyber threats.

Another significant percentage, 45% of enterprises, views Data Engineers and Analysts as crucial for managing and analysing data to optimise processes and enhance decision making. Similarly, almost 42% of industries regard AI and Machine Learning Specialists as significant roles for implementing AI algorithms and machine learning models to enhance automation, decision-making, and predictive capabilities.

A smaller percentage, 29% of companies, considers Analytics Developers important for optimising informed decision-making. Roughly 26% believe in the growing significance of Smart Factory Managers, Web Security Experts and Operational Technology Performers, overseeing the integration of intelligent technologies, safeguarding digital assets, and maintaining operational technology systems for smooth industrial processes. CAD and CAM Engineers/Designers are highlighted by just over one-fifth (22.6%) of businesses for designing and optimising components and processes in manufacturing, with a lesser percentage for Digital Twin Analysts and AR/VR Integration Specialists.

Figure 11. Digital Skills Necessary in Industry's Production Processes

Skill	Percentage
Automation and Mechatronic Systems Technicians	58.1%
Robotics Specialist/ Human-Robot Interaction Operator	48.4%
Cybersecurity Specialist; Internet of Things (IoT)…	48.4%
Data Engineer/Scientist	45.2%
AI and Machine Learning Specialist	41.9%
Analytics Developer	29%
Smart Factory Manager	25.8%
Web Security Expert	25.8%
Operational Technology Performer	25.8%
Computer-Aided Design (CAD) and Computer-Aided…	22.6%
Digital Twin Data Analyst	16.1%
AR/VR Integration Specialist	12.9%
Additive Manufacturing (3D printing) Specialist	6.5%

3.3 GREEN SKILLS IN ADVANCED MANUFACTURING

The perception of the green skills shortages and its impact on business activities is very different from that of digital skills. As observed in Figure 12, about 50% of companies express partial disagreement regarding the significant impact of a lack of skills on their transition to more sustainable practices, while 30% strongly disagree. Industries may not perceive a direct obstacle to adopting sustainable practices due to a lack of competencies. Instead, the deficiency primarily affects the overall production line, as indicated in previous charts, particularly due to a lack of technical qualifications. To provide a broader context, it can be assumed that 80% of industries (considering both totally disagree and somewhat disagree ratings) assert that skills shortages do not impede their implementation of green initiatives in business activities.

Figure 12. Impact of Skills Shortages on Greenification of Business Activities
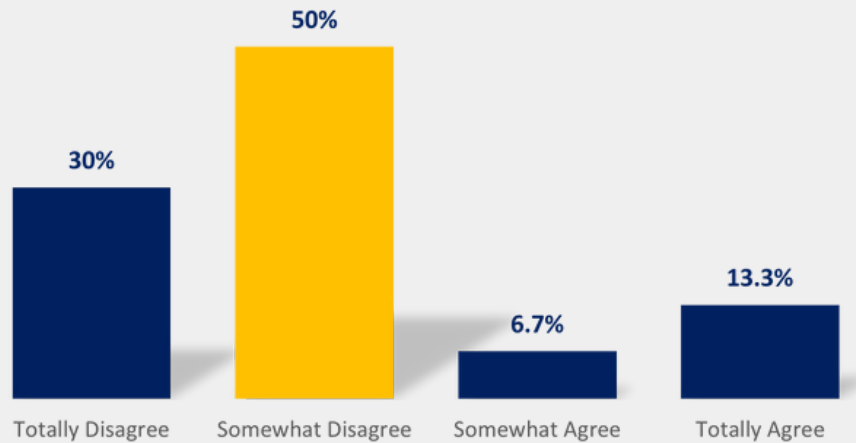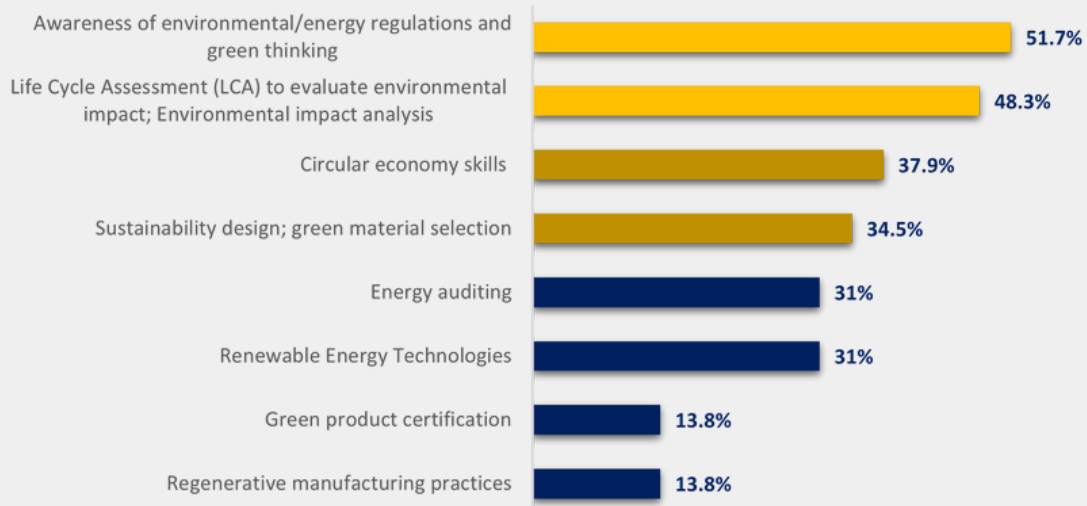

Figure 13 portrays a business landscape where sustainable practices have become integral to the vision of companies and their production. The survey results show that more than half enterprises (52%) prioritise Environmental and Energy Regulation awareness in their operations. This indicates a general green thinking as well as awareness on compliance with environmental standards and regulations, aligning with a broader trend towards sustainability and eco-friendly practices. While 48% of industries place importance on the knowledge of Life Cycle Assessment (LCA) to evaluate environmental impact of machinery manufacturing throughout their life cycle.

Circular Economy skills emerge as crucial for 38% of companies, emphasising the increasing adoption of circular principles in production processes such as shift towards more sustainable and regenerative practices. Additionally, 34.5% of companies consider sustainability design important and green materials selection, incorporating eco-friendly principles into the very design and conceptualisation of machines.

More than 30% of manufacturing businesses also perceive knowledge in energy auditing and renewable energy technologies as quite improtant, which is aligned with the goals of the Green Deal to reduce carbon footprints and embracing cleaner energy sources by 2050.

Understandably, green skills involve more than just technical know-how; they also encompass transversal skills related to sustainability principles, environmental regulations green thinking. This includes a combination of knowledge, values, and attitudes that empower professionals to make environmentally conscious decisions, regardless of whether they hold a formal 'green' title.

Figure 13. Green Skills Necessary in Industry's Production Processes

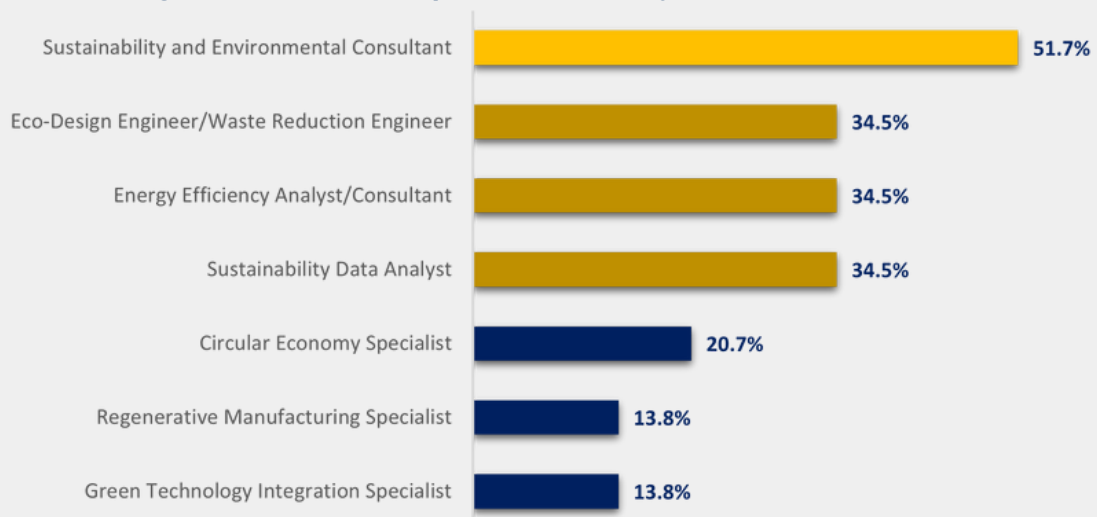| Skill	Percentage
Awareness of environmental/energy regulations and green thinking	51.7%
Life Cycle Assessment (LCA) to evaluate environmental impact; Environmental impact analysis	48.3%
Circular economy skills	37.9%
Sustainability design; green material selection	34.5%
Energy auditing	31%
Renewable Energy Technologies	31%
Green product certification	13.8%
Regenerative manufacturing practices	13.8%

3.4 GREEN PROFESSIONAL PROFILES

Figure 14 unveils a forward-looking perspective on the anticipated Green Professional Profiles that are expected to be essential in the manufacturing landscape over the next 5-10 years. Sustainability and Environmental Consultants take the lead as the most crucial professionals, with nearly 52% of respondents recognising their importance. These experts are expected to be a driving force in ensuring companies adhere to environmental regulations and facilitating the seamless integration of eco-friendly strategies into manufacturing processes.

Approximately 34.5% of enterprises indicate a demand for professionals in roles such as Eco-Design Engineers and Waste Reduction Engineers. These individuals are anticipated to incorporate sustainable practices at both the design and operational stages, with a specific focus on minimizing waste. Additionally, there is a recognised need for Energy Efficiency Analysts/Consultants and Sustainability Data Analysts to optimise energy consumption and assess sustainability measures. Furthermore, Circular Economy Specialists are considered quite important by nearly 21% of industries, recognising the relevance of circular principles in manufacturing.

Figure 14. GREEN Occupations Necessary in the Next 5-10 Years

Occupation	Percentage
Sustainability and Environmental Consultant	51.7%
Eco-Design Engineer/Waste Reduction Engineer	34.5%
Energy Efficiency Analyst/Consultant	34.5%
Sustainability Data Analyst	34.5%
Circular Economy Specialist	20.7%
Regenerative Manufacturing Specialist	13.8%
Green Technology Integration Specialist	13.8%

4. EDUCATION AND TRAINING

Education and training are two interconnected elements crucial for preparing young professionals to acquire the necessary qualifications and competencies for entry into the world of innovation and machinery production in advanced manufacturing sector. Education provides foundational theoretical knowledge required to engage in the manufacturing loop, while training provides hands-on experience at company sites where actual production occurs. Ther strong connection between the two ensures that individuals not only understand theoretical principles but also have the hands-on practical skills needed in real-world applications.
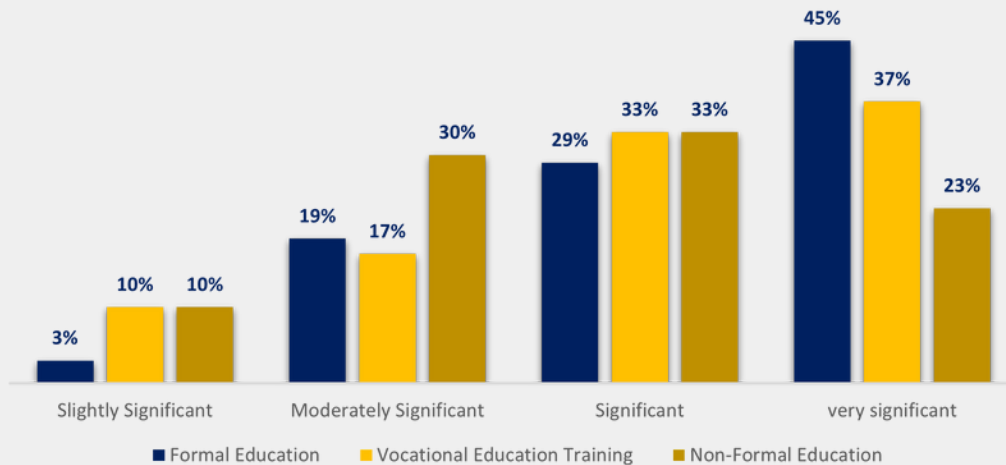
4.1 EDUCATION IN ADVANCED MANUFACTURING

Figure 15 illustrates that approximately 74% and 70% of industries recognise the importance of both Formal Education and Vocational Education and Training (VET) for skills development, with 56% considering non-formal education. It is worth noting the difference between Formal Education, which involves academic like degrees, diplomas, certificates etc. and Non-Formal Education, encompassing learning through daily life experiences, apprenticeships, workshops, voluntary work. Consequently, almost three-quarters of companies, value formal education provided by colleges and universities as a pivotal step towards a career in manufacturing, emphasising the importance of understanding fundamentals before applying knowledge.

Similarly, the relevance of VET remains high, comparable to formal education, as it integrates practical skills and knowledge with hands-on training from technical and vocational schools, preparing individuals for specific careers such in robotics and machine tool industries.

Regarding the informal education outside traditional settings, slightly more than half of enterprises between formal degrees and diplomas, view informal education as an integral component for acquiring qualifications essential for blue-collar jobs in manufacturing. Conversely, 30% of respondents believe that that non-formal education holds moderate significance in the workforce recruitment process.

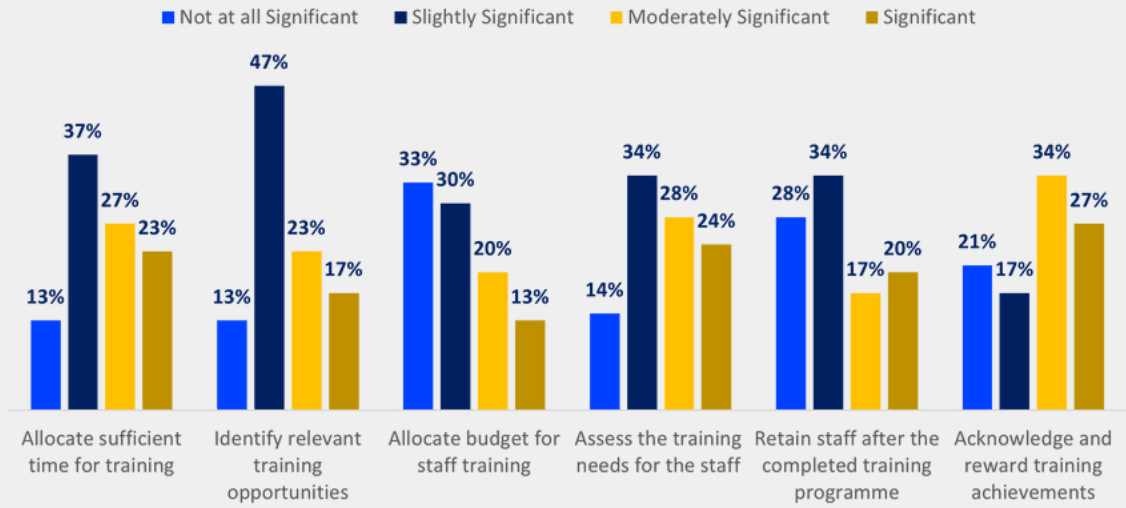**Figure 15. Types of Education Significance**

4.2 TRAINING CHALLENGES IN ADVANCED MANUFACTURING

Figure 16 outlines the challenges industries face in training their workforce. In terms of allocating sufficient time for training, 37% of enterprises report no significant difficulty, 27% express neutrality, and only 23% find it significantly challenging. Regarding the identification of relevant training opportunities, 47% industries face minimal challenges, 23% experience moderate challenges, and less than 20% encounter significant hurdles. Regarding budget allocation for staff training, the majority, comprising 33%, faces no financial constraints, 30% encounters slight difficulties, and 20% experiences moderate challenges. Notably, 75% of survey respondents represent Large and Medium-sized companies, suggesting that financial constraints may impact small to micro companies more significantly.

Assessing the training needs for staff is considered a slightly significant challenge by 34%, a moderate challenge by 28%, and a significant challenge by over 24%. Evaluating training needs demands constant monitoring, regular skill assessments, and the ability to identify areas for improvement. Regarding staff retention post-training, nearly 30% find it not challenging, 34% see it as a slight challenge, 20% perceive it as significant, and 17% consider it a moderate challenge. In acknowledging and rewarding workforce for training achievements, 34% face a moderate difficulty, 27% experience significant challenges, while 21% face no issues, and 17% encounter minimal challenges.

In summary, allocating sufficient time for training, assessing staff training needs, and acknowledging training achievements pose challenges for all types of companies. However, smaller companies with limited resources may face more pronounced difficulties in identifying training opportunities, allocating budgets, and retaining staff post-training.

Figure 16. Difficulties Companies are Experiencing in Training

■ Not at all Significant ■ Slightly Significant ■ Moderately Significant ■ Significant

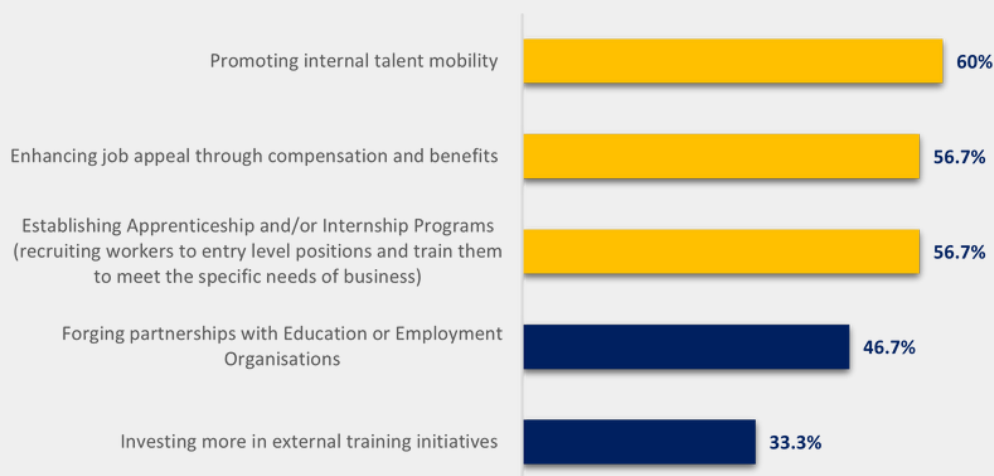| Category	Not at all Significant	Slightly Significant	Moderately Significant	Significant
Allocate sufficient time for training	13%	37%	27%	23%
Identify relevant training opportunities	13%	47%	23%	17%
Allocate budget for staff training	33%	30%	20%	13%
Assess the training needs for the staff	14%	34%	28%	24%
Retain staff after the completed training programme	28%	34%	17%	20%
Acknowledge and reward training achievements	21%	17%	34%	27%

5. GETTING AHEAD IN THE TALENT ACQUISITION MARATHON

5.1 PRACTICES FOR TALENT AVAILABILITY AND STAFF RETENTION

Surveyed companies were queried on the actions they deem most beneficial in securing and retaining staff with the requisite skills. As per Figure 17, 60% of industries identified promoting internal talent mobility as a key strategy for retaining qualified staff. Additionally, almost 57% of enterprises emphasised the importance of enhancing job appeal through competitive compensation and benefits packages, especially given the manufacturing sector's perceived undervaluation among young people and women. Another significant measure involves establishing apprenticeship and internal programs aimed at recruiting workers for entry-level positions and providing tailored training to meet specific business needs.

Around 47% of companies highlighted the value of forging partnerships with Education and Employment Organisations. Such partnerships aim to develop more customised educational programmes for the advanced manufacturing sector, inform young individuals about the sector's benefits and opportunities, and emphasise potential career growth. Lastly, a smaller percentage of companies expressed interest in higher investment in external training initiatives in collaboration with training providers operating outside of their premises.

Figure 17. Actions for Retaining Staff with the Required Skills

Promoting internal talent mobility — 60%

Enhancing job appeal through compensation and benefits — 56.7%

Establishing Apprenticeship and/or Internship Programs (recruiting workers to entry level positions and train them to meet the specific needs of business) — 56.7%

Forging partnerships with Education or Employment Organisations — 46.7%

Investing more in external training initiatives — 33.3%

Additionally, beyond competitive wages and a structured talent progression system, companies can enhance their appeal by providing flexible work arrangements. Transparent internal communication strategies contribute to an engaged workplace culture, and investing in effective reskilling and upskilling initiatives ensures that employees remain adept in a rapidly evolving professional landscape.

5.2 INDUSTRY AND TRIPLE PARTNERSHIP

The swift evolution of technology poses a significant challenge for Vocational Education and Training (VET) institutions and the broader educational landscape, both struggling to keep pace with the latest advancements. The solution lies in consistently updating curricula and enhancing the skills of educators, highlighting the need for strong collaboration between businesses and educational institutions.

The mismatch between the offer of educational institutions and trainings and the demand of industries contributes to the persistent skills gap and shortages that constrain companies. Collaboration and partnerships can lead to more significant achievements than what can be accomplished by individuals or organisations working in isolation.

Industry and Academia Collaboration

To address the labour shortage and the lack of workforce interest in manufacturing industries, an effective strategy involves enhancing the job description's appeal. This includes highlighting the benefits of the working environment, both socially and financially, and creating targeted promotional campaigns in collaboration with European and National governments. These campaigns should raise awareness within educational institutions about the intriguing aspects of manufacturing and its remunerative potential.

The collaboration between industry and academia is paramount in bridging the skills gap and enhancing employability. Early engagement of companies with schools can encourage students and parents to consider career opportunities in the manufacturing sector. Efforts to attract more young people to technical degrees should commence early in the educational path, even during school years. This could involve company visits to schools, explaining the advantages of working in manufacturing, and organising tours for students to experience the innovative world within factories.

Additionally, educational institutions should incorporate topics like the digitisation of the economy, digital skills, sustainability, and green skills (green mindset) into their teaching programmes from high school onwards. Tailoring educational programmes to industry demands, offering specialised courses, and providing increased time for regular trainings are essential for ensuring students gain hands-on experience in operating machines, robotics, and managing data-driven technologies. This holistic approach aims to cultivate a skilled workforce ready to meet the demands of the modern manufacturing landscape.

Industry and Training Centres Collaboration

New job roles are emerging due to the impact of digitalisation and the challenges posed by environmental sustainability. However, the SMEs suggest that the creation of entirely new jobs may not be immediate in the short and medium term. Instead, the existing workforce will undergo a transformation, acquiring the new skills required to confront evolving challenges. Therefore, it becomes imperative for existing training courses to adapt and incorporate competencies in the realms of digitalisation and green practices. This ensures that individuals undergoing training are equipped with the necessary knowledge and skills to effectively navigate and address the digital and environmental challenges that industries are facing.

Industry and Governments – EU Policymakers collaboration

Collaboration between industry and governments, particularly with EU policymakers, can play an important role in fostering the creation and execution of green and digital skills development programmes that align with the evolving labour market demand. Effective policymaking should include evaluations of labour market success and the alignment of curricula with job market needs. The establishment of public-private partnerships bringing together Ministries of Education, VET institutions, employment agencies, enterprises and other stakeholders could lead not only to the development of integrated education policies, but also to the implementation of actions, measures and activities to assess progress and identify skills gaps. The EU has already established the Pact for Skills initiative, designed to enhance upskilling and reskilling opportunities for the working-age population, through public and private partnerships of all stakeholders.

5.3 UPSKILLING – RESKILLING INITIATIVES

Regular Skills Assessments and Established Career Paths

Some of the effective strategies/programmes that the surveyed companies have implemented for upskilling or reskilling their workers in the advanced manufacturing field include:
- advertising of vacancies before opening them to external candidates
- established career paths for current employees
- regular assessments of the workforce's skills with competency ratings.

Similarly, the creation of personal development plans by managers, in collaboration with employees, to monitor progress and career growth, should be complemented by acknowledgement and rewards for their dedication, ensuring employees' motivation and satisfaction.

Internal Mobility Promotion through training, especially within production/distribution environments, supports the training of workers for multiple or most existing positions. Businesses equipped with the necessary resources can employ individuals in entry-level roles and subsequently provide in-house training in high-demand areas. For instance, an operator may undergo retraining to transition into the role of a software engineer.

On this note, continuous training programmes for reskilling and upskilling prove to be strong motivators for employees to remain committed to the company.

Dual Training

Another crucial point involves the incorporation of dual training, which combines traditional classroom-based learning with hands-on, on-the-job training. Students or apprentices split their time between formal education at educational institutions, like schools or vocational training centres and practical training within a workplace provided by the company as part of their routine operations. Dual training will help individuals transition to new roles within industries.

School/University Visits

Involves regularly visiting schools and universities, inviting students to join the company immediately after graduation and thus, showcasing the specific competencies and technical knowledge industries require. Beyond attracting potential new candidates to the manufacturing field, it also adds pressure on the existing workforce to enhance their skills through participation in reskilling and upskilling programs.

Academic-Industrial Partnership and Continuous Learning

Building partnerships between industries and top Engineering schools on R&D / PhD programmes initiated by end-users combines academic knowledge from the school with practical industrial know-how provided by the application engineers of the machine-tool builder and addresses end-user needs.

5.4 POLICY RECOMMENDATIONS – FOR SKILLS HARMONY

The EU and national governments can effectively address the current skills shortage and prepare for future digital and green skills gaps in the advanced manufacturing sector, as highlighted by surveyed companies and CECIMO's Recommendations for the 2024-2029 EU institutional cycle.

Key recommendations include:

- **Adapting educational curricula to market demands**, tailoring them to specific industry sectors and incorporating courses on green and digital skills. Educational institutions should inform students about opportunities in manufacturing professions and devise strategies to attract them.

- **Boosting the appeal of STEM education and the manufacturing industry** through National and European Campaigns. Emphasise the sector's benefits and career growth potential to address labour deficits and elevate the prestige in industrial professions. This includes raising awareness about the sector's role in digital-green transition, especially among younger demographics.

- **Ensuring adequate funding for tailored training programmes**, particularly in the departments of Production, Mechanical/Industrial Engineering and Electrical Engineering. This will ensure robust upskilling and reskilling activities in response to evolving technologies. Additional investments in STEM education and scholarships will contribute to increased university degrees and provide broader opportunities to diverse talent.

- **Promoting short-term learning pathways and flexible certification options** through vocational training. This approach aims to achieve demand-oriented competencies, which involves endorsing personalised learning strategies and advocating for more flexible certification options.

- **Facilitating collaboration for Lifelong Learning** by implementing tailored adult-learning strategies and development plans. Recognising that university education alone cannot supply all the necessary skills for a professional lifetime, this initiative involves competency-based learning. Diverse cooperation between European and national governments, industries, education, and VET is crucial to ensure training aligns with market demands.

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ABOUT CECIMO

CECIMO is the European Association of Manufacturing Technologies. With a primary focus on machine tools and additive manufacturing technologies, we bring together 15 national associations, which represent approximately 1500 industrial enterprises in Europe (EU + UK+ EFTA + Türkiye), over 80% of which are SMEs. CECIMO covers 97% of the total machine tool production in Europe and about 1/3 worldwide. It accounts for approximately 150,000 employees and a turnover of around 25.3 billion euros in 2022

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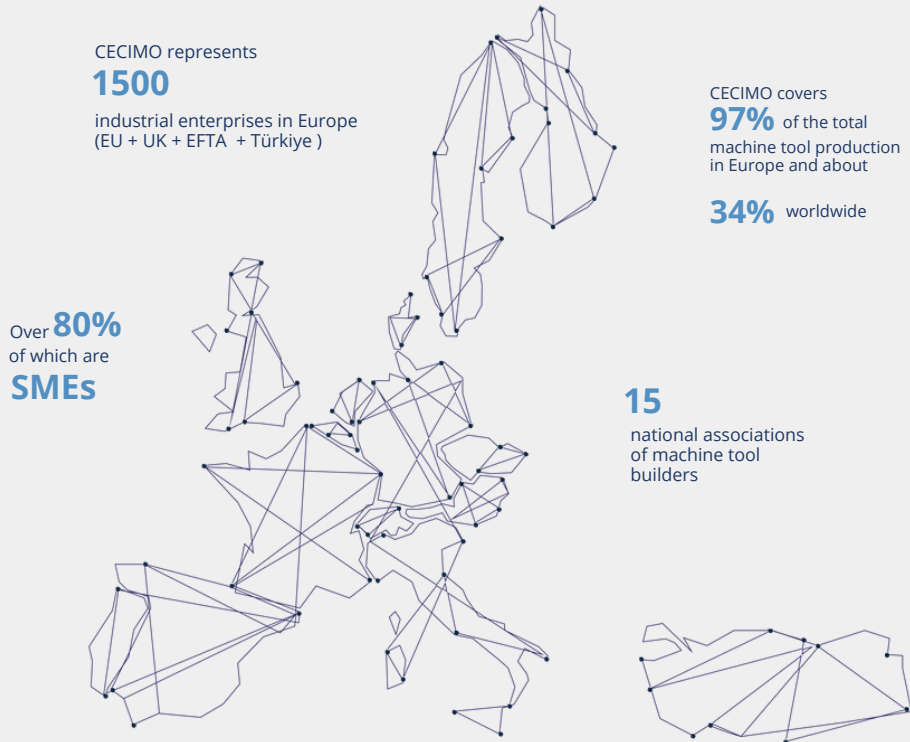
Austria: Metaltechnology Austria
Die MetalltechnischeIndustrie

Germany: VDW
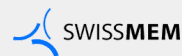Verein Deutscher Werkzeugmaschinenfabriken e.V.

Sweden: MTAS
Machine and Tool Association of Sweden

Belgium: AGORIA
The Federation of Technology Industry

Italy: UCIMU
Associazione dei costruttori Italiani di macchine utensili robot e automazione

Switzerland: SWISSMEM
Die Schweizer Maschinen-, Elektro- und Metall-Industrie

Czech Republic: SST
Svazu Strojírenské Technologie

Netherlands: FPT-VIMAG
FederatieProductieTechnologie / Sectie VIMAG

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United Kingdom: MTA
The Manufacturing Technologies Association

Finland: Technology Industries of Finland

Spain: AFM Cluster
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France: Evolis
Organisation professionnelle des biens d'équipement